KILLEARN LAKES WASTE WATER DISPOSAL STUDY

JUNE 1987

PREPARED FOR THE COUNTY BOARD OF COUNTY COMMISSIONERS

PREPARED BY THE LEON COUNTY PUBLIC HEALTH UNIT

IN COOPERATION WITH:

LEON COUNTY DEPARTMENT OF PUBLIC WORK
LEON COUNTY BUILDING DEPARTMENT
OCHLOCKNEE RIVER SOIL & WATER CONSERVATION DISTRICT
NORTHWEST FLORIDA WATER MANAGEMENT DISTRICT
TALLAHASSEE-LEON COUNTY PLANNING DEPARTMENT
FLORIDA DEPARTMENT OF HEALTH & REHABILITATIVE SERVICES
FLORIDA DEPARTMENT OF ENVIRONMENTAL REGULATION

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KILLEARN LAKES AREA
WASTE WATER DISPOSAL STUDY

At the request of the Leon County Commission, a waste water disposal study was initiated for the Killearn Lakes Subdivision area. The focus of this study was Unit I in regard to septic tank failures and what factors contribute to these failures. Unit II was a secondary concern given the current density and the time and resources available for this study. Combinations of soil conditions, water table elevations and storm water runoff are the major factors involved with their impacts magnified by the density of development.

A group was formed to coordinate the direction and emphasis of the study activities. The participants of the study group and are listed in Attachment A. This report represents a summary of the findings and recommendations of storm water and watershed evaluation by the Northwest Florida Water Management District, a soils interpretation and limitation schedule by the Ochlockonee River Soil and Water Conservation District, in conjuction with the USDA Soil Conservation Service, and a review of the existing stormwater design and performance levels by the Leon County Public Works Department. Also included in this report are recommendations and observations of the Leon County Public Health Unit (LCPHU) regarding onsite sewage disposal systems.

The Ochlocknee River Soil and Water Conservation District findings are found in Part I of this report. Part II contains the findings of the Northwest Florida Water Management District.

It is the conclusion of all parties involved that the findings in both studies clearly suggest that conditions are not favorable to the use of septic tank systems as a means of sewage disposal in Unit I and questionable in Unit II (as platted). In addition, increasing the number of septic tanks (through continued development) will only increase the failure rate. A central sewage collection, treatment and disposal system is the only viable solution to both short and long term sewage problems.

An adequately designed storm water collection system needs to be provided in order to minimize the existing and future runoff problems. The extent of these drainage problems (critical to satisfactory septic tank performance) is highlighted in a Killearn Lakes Homeowners Association survey (Attachment B). A designed drainage system is necessary in Unit I and Unit II regardless of the method of sewage disposal proposed.

Prior to this study, a survey was conducted by the LCPHU to determine surface water quality in the Killearn Lakes Unit I area. The purpose of this sampling was to determine whether there was widespread bacteriological contamination of surface waters due to failing septic tank systems. The results of the the sampling program did not indicate widespread degredation of surface water quality even though point sources of contamination may exist. The results of the sampling are included in Attachment C.

FINDING - POOR SOIL CONDITIONS AND PERCHED WATER TABLES

The predominant soils in Unit I have severe limitations for septic tank use based on USDA Soil Conservation Service ratings. These soils are typlified by the Dothan series described in Part I. A severe rating was assigned to this class because of slow permeability, perched water tables and excessive slopes.

The surface soil is normally composed of sandy loams and loamy sands while the subsurface soils are characterized by sandy clay loams and sandy clays. Most of the older septic tank systems (>2 years) were installed with the bottom of the drainfield at or slightly above the denser subsurface soils while most of the newer systems are "elevated" above this restricting layer.

Standard subsurface drainfields are installed at a depth that places the bottom of the drainfield within the slower percolating sandy clay loam soils. Given sufficient surface area these soils may be able to accept the amount of effluent produced by a typical household and disposed of by the septic tank system. In most cases, however, sufficient area is not available because of the small individual lot sizes.

More than 80% of the lots sampled in the Unit I area have severe limitations. Fifteen (15) % exhibit moderate limitations and only 5% show slight limitations. Ninety-three percent of the lots sampled in block X, as well as all the lots studied in block R and 50% of the lots in blocks Q,N,and P receive excess runoff from other lots and roads at higher elevations.

Soil texture greatly affects the soils ability to accept water. Loamy sands and clay soils are slowly permeable soils which accept water at increasingly slower rates as the soil texture moves from loam to clay.

Dothan type soils range from loamy sand and sandy loam in the first 18" to sandy clay loam for the rest of the profile. The first 18" of the profile accepts water at a relatively faster rate than the rest of the soil profile. Water moving vertically through the profile is slowed the deeper it travels. This causes the faster moving downward flow to "perch" above the deeper, slower moving flow resulting in an artificial water table.

Septic tank systems will continue to fail, in these soils, as the density increases and more pervious areas are removed from the total area available for infiltration.

Based on the limited sampling done in Killearn Lakes Unit II similar conditions to those in Unit I were found to exist. Although the predominant soil in Unit II is different from that in Unit I, they both soil types exibit some of the same characteristics. Both soils have textures that are predominantly sandy loam and sandy clay loam. Both have slow percolation rates. Orangeburg soil, the predominant soil of Unit II, is rated as moderately limited for septic use due to the slow percolation rate. Under normal conditions the seasonal high water table can be expected to be 72 inches below the ground surface. Should conditions develop, as they have in Unit I, to elevate the water table above normal, an increase in septic failures can be expected in Unit II as the density of homes increase.

It has been determined that the use of french or curtain drains alone will not significantly reduce perched water tables due to the low permeability of the soil. This is the case with or without a master drainage plan in effect.

FINDINGS - HIGH DENSITY DEVELOPMENT

Both Unit I and Unit II of the Killearn Lakes subdivision contain lots which contain approximately 1/4 acre of net useable land with abutting "green" areas in common. Although the overall density of the subdivision is more than 1/4 acre per individual lot, the additional land is devoted to "green areas" , utilities and roads. The green areas should not be considered as useable land with respect to septic tank systems since most are depressions or repositories for storm water runoff. During the wet season these areas are typically saturated at the surface.

The green areas are well suited to storm water movement, due to their location and elevation, but do not serve each lot on an individual basis. The roads add to the total imprevious surface and act as a medium for the movement of water between lots.

FINDING - INADEQUATE STORM WATER DRAINAGE

Killearn Lakes utilizes a stormwater drainage system known as "sheet flow." This allows stormwater to flow along the natural contours to a main discharge area. Because of its dependency on the natural contours to provide drainage, sheet flow drainage patterns may be hindered by development. Buildings, roads and driveways become barriers to the natural flow of water by diverting it to other areas causing drainage problems for downstream properties. In addition to this, these same barriers also create impervious areas which were once used to absorb stormwater. As development increases and more green areas are removed from use, those areas nearing saturation will be required to accommodate even more amounts of water - compounding the existing drainage problems.

The overall density of Killearm Lakes is not particularly high, buth the individual lots are small (approximately 1/4 acre in size). The sheet flow concept implies runoff cascading across the terrain in an unconcentrated fashion. But due to the lot small sizes, the stormwater runoff is concentrated. Instead of sheet flow drainage, the drainage is uncontrolled concentrated runoff. Since there is no designed drainage system, the runoff follows the path of least resistance. This could be someone's yard area, driveway, garage or front or back porch.

Uncontrolled concentrated runoff contributes to the septic tank problems. Septic tanks fail when the soil around them become saturated. In Killearn Lakes this concentrated runoff is flowing across the septic tanks and saturating the ground.

In subdivisions with designed drainage systems the runoff is removed from the lots and transferred to areas set aside to receive the runoff. If a designed drainage system were in place, the impact on the septic tanks would be lesser.

The impact of constructing a drainage system may be significant. This particular development has taken an extra effort to protect the tree environment. The green areas have not been cleared or excavated to provide for drainage flow. The right-of-way streets have not been cleared as trees were allowed to remain within six (6) feet of the edge of the pavement. To retrofit a typical drainage system to this development will be very expensive and will alter the natural aesthetics of the development. Efforts should be made to develop a compromise drainage design to provide for safe water runoff and maintain the character and aesthetics of the development.

If no effort is made to improve removal of stormwater runoff, drainage problems will continue to increase. More frequent and longer duration septic tank failures will ultimately occur.

FINDING - INACCURATE WATER TABLE INDICATORS

The determination of high water tables in soils is based primarily on indicators such as the presence of grayish soil colors and/or mottling. Mottling is the marbled appearance of the soil caused by the vertical movement of water through the soil layers. Under normal conditions, Dothan soils (the predominant soil type found in Unit I) has a predictable seasonal high water table of 42 to 48 inches below the ground surface. This is characterized by the presence of mottling at about 38 inches below the ground surface. During wet periods Dothan soils can be expected to have a perched water table for brief periods of time.

Soil borings in Unit I showed Dothan soils with significantly higher water tables than would normally be expected. Forty-two percent of the lots evaluated showed Dothan soils with average high water tables well above expected levels; as high as 12 to 20 inches. These abnormally elevated water tables can be attributed to developmental density and inadequate storm water drainage.

The ability to predict the estimated wet season water table insures that the drainfield will be installed above the saturated zone. Without this ability, septic tank systems could be installed at depths which would insure satisfactory function during the dry months but would fail to dispose of household water during the wet season.

I. ONSITE SEWAGE DISPOSAL RECOMMENDATIONS KILLEARN LAKES UNIT I AND UNIT II

1. A central sewage system should be provided in Killearn Lakes Unit I and later extended to Unit II.

2. An adequately designed storm water collection system should be installed to minimize existing problems as well as to prevent future problems from developing in both Unit I and Unit II. See Part II of the recommendations.

3. No onsite sewage disposal system permits should be issued in Unit I until a stormwater system has been constructed and the system demonstrates success in collecting stormwater and lowering the perched water table on specific lots under review.

4. Onsite sewage disposal system permits should not be issued in Killearn Lakes Unit II where soils are rated severe based on USDA soil limitations.

5. Onsite sewage disposal systems proposed for moderate limited soils in Unit II should be "mounded" to provide adequate separation from the bottom of the drainfield to the water table or slowly permeable sandy clay loam layers.

6. The Health Department should consider allowing/ permitting "experimental" onsite sewage disposal system designs to overcome existing failures in Unit I. However, no repairs (other than pumping) shall be initiated in Killearn Lakes Unit I without receiving prior written approval from the Health Department.

II. STORM WATER COLLECTION AND DISPOSAL RECOMMENDATIONS KILLEARN LAKES UNIT I AND UNIT II

1. Leon County should not accept the present sheet flow concept in Killearn Lakes Unit I and Unit II.

2. Request that a more detailed analysis be made of the Unit I and Unit II development to provide for a final design and construction of stormwater runoff system. Within this detailed analysis should be the impacts to downstream water bodies. This analysis should also include:

a. Complete evaluation of the existing system.

b. A determination of the capacity of the existing system.

c. A determination of existing flooding problems and the anticipated problems for built-out conditions.

d. Design of the system to accommodate built-out conditions.

e. An examination of design impacts on downstream water bodies.

f. The preparation of construction plans and specifications for drainage improvements in both Unit I and Unit II.

g. The construction of drainage improvements in Unit I and Unit II.

3. Develop a Master Drainage Plan for selected water sheds in the Lake Iamonia Basin. This can be incorporated in the Leon County/City of Tallahassee Master Drainage Plan that is presently being prepared. To accomplish this, the contract with Northwest Florida Water Management District will have to be modified at additional costs.

ATTACHMENT A
KILLEARN LAKES AREA
WASTE WATER DISPOSAL STUDY

PARTICIPANTS

Parwez Alam	Leon County Public Works
Jeff Allen	USDA Soil Conservation Service
Doug Barr	Northwest Florida Water Management District
Raymond Collins	Leon County Public Health Unit
Arthur Cooper, Chairperson	Leon County Public Health Unit
Jim Courtney	Leon County Building Dept.
Augustine Maristany	Northwest Florida Water Management District
Bill McCartney	Northwest Florida Water Management District
Gerald Neubauer	Department of Environmental Regulation
Tony Park	Leon County Public Works
Candace Trimble, Tecnical Study Team Leader	Ochlockonee River Soil and Water Conservation District
Mark Stamps	Tallahassee/Leon Planning Department

ADDENDUM

PLANNING AND ZONING RECOMMENDATIONS

LEON COUNTY SUBDIVISIONS

The following recommendations are made for improvements in the planning and zoning aspects of land development to better insure that satisfactory conditions exist for the use of onsite sewage disposal systems prior to development.

These recommendations were developed through meetings with the Killearn Lakes Waste Water Disposal Study Group, planning/zoning staff and the Leon County Public Health Unit.

1. All applications for zoning changes should include information regarding the proposed method of sewage disposal and source of potable water. If this information is not provided voluntarily by the applicant, the requested zoning change should be presumed to contain the highest possible density allowed under the requested zoning designation. Recommendations for approval or disapproval will be based on the use of onsite sewage disposal systems (septic tanks) and individual private wells at that density.

2. A representative of the Ochlocknee River Soil and Water Conservation District or the USDA Soil Conservation Service should be included in the review process for zoning and preliminary plat reviews by participating in Technical Coordinating Committee (TCC) activities.

3. All preliminary plat reviews should include sufficient detailed information to asses overall sewage disposal, potable water and storm water needs based on individual lot or block evaluations.

4. Agricultural density should be reviewed to make clear demarkation of intended agricultural use and/or urban use. In agricultural zoning, onsite sewage disposal and private wells should be anticipated. The maximum allowable density under current Chapter 10D-6 standards is two (2) net lots per acre while local zoning designations allow 2.18 lots per acre.

KILLEARN LAKES WASTE WATER DISPOSAL STUDY

Prepared for: Leon County Public Health Unit

Prepared by: Ochlockonee River Soil and Water Conservation District and Soil Conservation Service Staff;

Candace Trimble, District Conservationist
William J. Allen, Soil Scientist
Darrell A. Johnson, Soil Conservationist
Clifford Still, Soil Conservationist Trainee

Date: May 26, 1987

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I. Situation

In early March the District Conservationist for the Ochlockonee River Soil and Water Conservation District was called regarding a series of septic tank failures in a Killearn Lakes subdivision. A field trip to the Unit I section of Killearn Lakes subdivision was attended by representatives from various State and Local environmental agencies. From that meeting the Leon County Public Health Unit (LCPHU) requested technical assistance from the ORSWCD and assigned Soil Conservation Service staff to conduct an in depth soil survey and site evaluations to determine the cause of these septic tank failures. The following elements were studied:

1. Soil Series
2. Estimated wet season water table depth and duration
3. Actual observed soil water table depths.
4. Flood Hazard Rating (USDA system)
5. Soil Permeability
6. Soil Textures
7. Slopes
8. Soil Hydrologic Group
9. Degree and Nature of Limitations for uses:
   a. Septic Tank Absorption Fields
   b. Low Buildings, Roads and Streets

This report addresses each of these elements in relation to the influence they may have on the function of on site effluent disposal systems, specifically, septic tank absorption fields.

II. Extent of Soil Investigations

The procedures used in the study of Killearn Lakes Units One and Two are consistent with United States Department of Agriculture (USDA) soil investigation techniques.

A. Unit I

Five blocks in Unit I were studied. These are: Blocks X, R, N, Q and P.

Manual auger borings were made at approximately five lot intervals for blocks X, R, N and Q. Block P borings were slightly less frequent due to

the density of existing development. The borings were made to 48 inches or greater depths.[1]

Soil textures were examined and textural changes identified. Soil permeabilities were then estimated from observed soil textures based on USDA records for the soil series identified.[2]

'Normal' wet season water tables were estimated using soil characteristics observed such as soil color and the presence of mottling and compared with USDA records for the soil series identified.[2] Saturated zones at the time of investigations were also noted.

In addition approximate land slopes which direct surface runoff onto various lots or from those lots toward adjacent lots were noted. Percent slopes were measured using a clinometer.[3]

B. Unit II

A random, less frequent sampling was performed in Unit II. Evaluation procedures were consistent with those used in Unit I.

[1] This depth was chosen based on Florida Health & Rehabilitative Services Code 10D-6 water table evaluation depth.

[2] USDA-Soil Interpretation Records-Soils 5's.

[3] Percent slope is the number of feet vertical change in a 100 foot horizontal interval.

III. Findings

A. Unit I

The following conditions were established through soil investigations in Unit I. These trends account for all lots sampled in the Unit I investigations.

1. Soil profiles indicating high water tables. On site investigation did not find saturated zones at the time of the study. However, high water tables would be expected to the level of the indicators under natural conditions during the wettest season. Experience with similar soils in the Killearn Lakes area would lead one to expect water tables above this level during the

wettest season. These account for 22 percent of the lots sampled.

2. Soil profiles indicating high water tables where saturated zones were observed within the range expected under natural conditions. Approximately 17 percent of lots sampled.

3. Soil profiles indicating high water tables, but on site investigations observed saturated conditions at depths significantly above the indicated range. These consist of about 42 percent of lots sampled.

4. Soil profiles where no water table was indicated and no saturated zones observed. Approximately 13 percent of the lots sampled.

5. Profiles exhibiting extremely heavy clay and a sandy clay subsoils, in general, containing relatively unweathered parent material clays.

Based on the conditions observed and soil records Soil Properties and Limitations Tables were developed for the lots sampled. (See tables on pages 5-25 of this report).

The following limitations were identified for on site effluent disposal systems (septic tank absorption fields):

Severe Limitations were identified for 82 percent of the lots sampled in Blocks X, R, N, Q and P. The nature of the limitations for the predominant soil, Dothan series, are wetness (due to perched water table) and slow percolation (due to soil texture and subsoil permeabilities).

Moderate Limitations were identified for only 15 percent of the lots sampled in Unit I, in general due to slow percolation rates.

Slight Limitations were identified on 3 percent of the lots sampled.

In addition to the limitations discussed above, on site investigations identified significant surface water runoff hazards to 93 percent of lots studied in Block X, all lots studied in Block R and 50 percent of the lots studied in Blocks, Q, N and P.

B. Unit II

All areas sampled in Unit II investigations fall within one condition category. Soil profiles which do not indicate high water tables and no saturated zones observed.

These conditions indicate the following limitations for on site effluent disposal systems:

Moderate limitations are identified on 95 percent of lots sampled. The nature of the limitation for the predominant soil, Orangeburg series is due to slow percolation rates.

Slight limitations were observed on five percent of lots sampled in Unit II.

Significant surface water runoff hazards are apparent throughout Unit II. Only those lots located at the tops of hills are expected to be free from surface runoff related problems. Needless to say, runoff from these few areas will impact adjacent downslope development.

NOTE: For more detailed information related to Soil Properties and Limitations for development uses see section III-C of this report.

IV. Conclusions

A. Unit I

Soils poorly suited to on site effluent disposal predominate in Unit I. Water tables significantly above what would be expected under natural conditions were observed on 42 percent of the lots sampled in Unit I. It appears that the increased volumes of water generated by development have created these unnaturally high water tables.

Site conditions (the slowly permeable soils which comprise most of the developable areas and the saturated conditions which are found in the majority of the green areas) indicate that little can be done to alleviate existing on site effluent disposal system failures. Furthermore, continued development, the addition of more impervious surfaces in Unit I, will increase the septic tank system failures in extent and duration. Some relief of the duration and extent of failure MAY be obtained through the provision of a surface water management system.

Sewage system installation would appear to be the only long term acceptable solution to the effluent disposal problems in Unit I.

B. Unit II

Soil conditions are, for the most part better and in some cases significantly better for on site effluent disposal in Unit II. Nonetheless, it should not be ignored that most of these soils are not ideal for on site effluent disposal and that system function is impacted by development density and surface runoff.

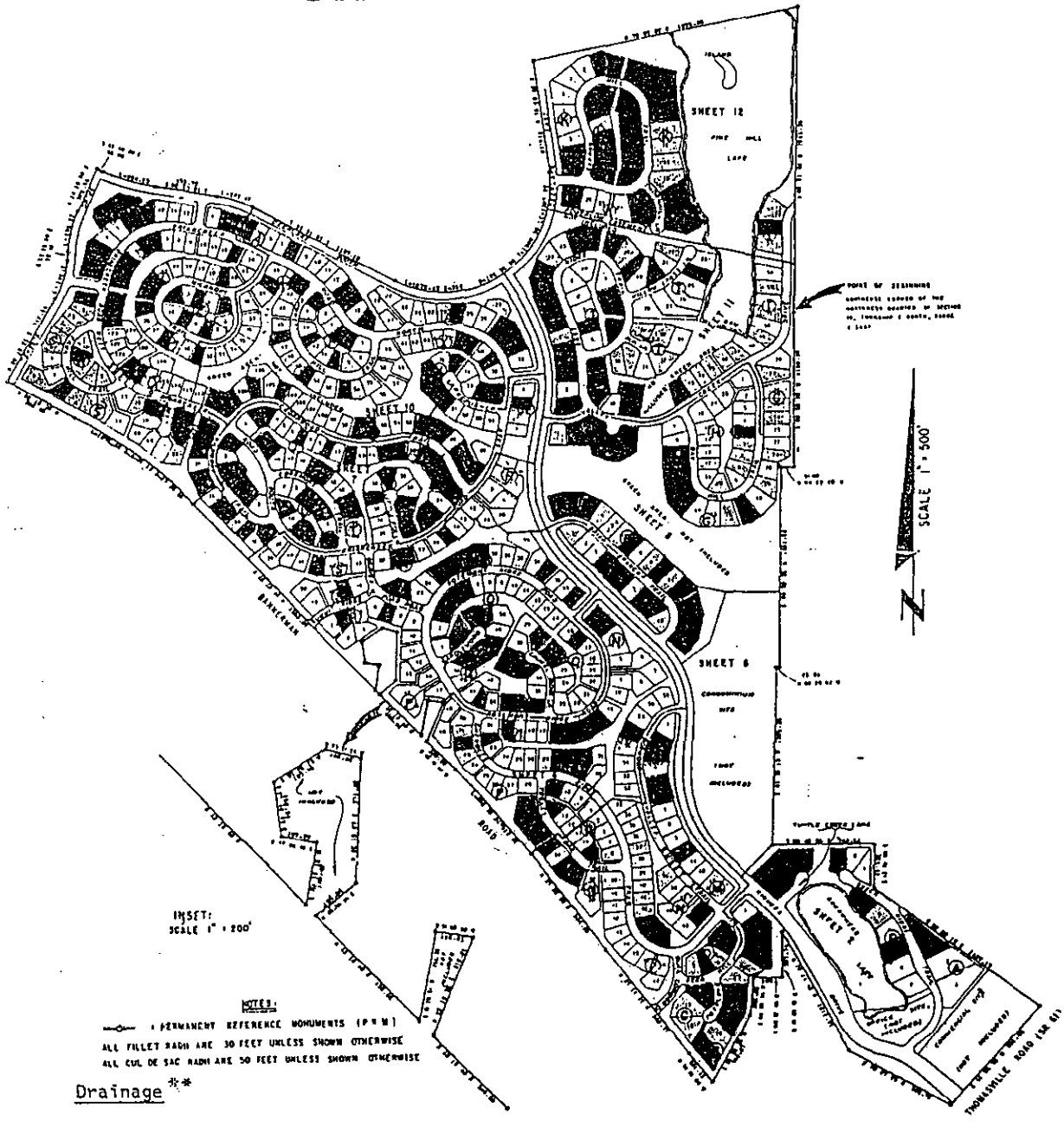
It is reasonable to conclude that the extent, degree and severity of system failures in Unit II is expected to be less than that experienced in Unit I. However, increasing density and related surface water management problems can be expected to be translated into increasing septic tank failure rates in Unit II.

The provision of an off site sewage treatment system is therefore desirable in Unit II.

KILLEARN LAKES UNIT I DRAINAGE PROBLEM SURVEY *

Killearn Lakes

Unit 1



Drainage **

Problems	
No Problems	
No Report	

* Information provided by Killearn Lakes Homes Association

** Vacant lots shown in white

TABLES

MAJOR SOIL PROPERTIES, DEGREE AND NATURE
OF LIMITATIONS FOR SELECTED USES

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MAJOR SOIL PROPERTIES, DEGREE AND NATURE OF LIMITATIONS FOR SELECTED USES

repared for: Killearn Lakes Waste Water Disposal Study Unit I Prepared by: Candace Trimble Date: 4-9-87

oil name nd map ymbol	RELEVANT SOIL PROPERTIES 1/					DEGREE AND NATURE OF LIMITATION 1/				
	Depth to expected seasonal high water table	Flood Hazard (wetness)	Permeability (most restrictive layer) (in/hr)	Texture (various depths to 60")	Slope	Septic tanks	Soil Hydrologic Group	Low buildings roads and streets		Wetland Plants
10 Dothan Approx. (lot x-74)	3.0-5.0ft. Perched Jan-Apr	none	0.6-2.0 (12" +)	Sandy loam (0-12") sandy clay loam (12-40")	2-5%	Severe (2,3,4)	B	Moderate (2,4)		
	(water table: saturated at 14"; water table indicators occur at 40")									
10 Transition Orangeburg-Dothan Approx. (lot x-89)	3.0-5.0ft. Perched Jan-Apr.	none	0.2-0.6* (35-48")	sandy loam (0-20") sandy clay loam (20-35") sandy clay (35-48")	2-5%	Severe (2,3,4)	B	Moderate (2,4)		Occur at back of lo between larks-spur cedarwood & in green space.
	(water table: none observed; indicators at 35")									

* Estimated permeability-no previous sampling data available, estimated based on subsoil texture

** Surface runoff is not a standard soils limitation however site conditions indicate a significant runoff impact on septic tank function and building hazards.

ature of Limitation: 1. Slope 2. Wetness 3. Percs slowly 4. Surface runoff ** 5. Slipage soil subject to slipage downslop when loaded, excavated or wet.

/ Data shown only for properties most relevant to the planned land use.

oils rated as SLIGHT have few or no limitations for the use. Soils rated as MODERATE have limitations hat reduce to some degree their desirability for the purpose being considered. They require some orrective measures. Soils rated as SEVERE have unfavorable soil properties or features that severely estrict their use and desirability for the purpose ; major soil reclamation, special design, or ntensive maintenance is required.

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MAJOR SOIL PROPERTIES, DEGREE AND NATURE OF LIMITATIONS FOR SELECTED USES

Prepared for: Killearn Lakes Waste Water Disposal Study Unit I Prepared by: Candace Trimble Date: 4-9-87

Soil name and map symbol	RELEVANT SOIL PROPERTIES 1/					DEGREE AND NATURE OF LIMITATION 1/				
	Depth to expected seasonal high water table	Flood Hazard (wetness	Permeability (most restrictive layer) (in/hr)	Texture (various depths to 60")	Slope	Septic tanks	Soil Hydrologic Group	Low buildings roads and streets		Wetland Plants
10 Typic Hapludult arrox. lot lot x-95)	None	None	<0.06* (33-48")	sand (0-5) sandy clay (5-33") clay (33 +48")	2-5%	Severe (3,4)	C	Severe (4,5)		Natural stream in green space abo 100' from street about 1½' wide and about 1' deep
	(extremely heavy clay could not penetrate past 40") (no apparent water table)									
13 Faceville (Approx. lot x-101)	>6.0ft	None	0.6-2.0 (18" +)	loamy sand (0-18") sandy clay (18-48")	5-8%	Moderate (1,4)	B	Moderate (1,4)		
	(water table indicators: gray mottles at 48")									

Nature of Limitation: 1. Slope 2. Wetness 3. percs slowly 4. surface runoff 5. Slipage

1/ Data shown only for properties most relevant to the planned land use.

Soils rated as SLIGHT have few or no limitations for the use. Soils rated as MODERATE have limitations that reduce to some degree their desirability for the purpose being considered. They require some corrective measures. Soils rated as SEVERE have unfavorable soil properties or features that severely restrict their use and desirability for the purpose of major soil reclamation, special design, or intensive maintenance is required.

* Estimated permeability - no previous sampling data available - estimate based on subsoil texture.

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MAJOR SOIL PROPERTIES, DEGREE AND NATURE OF LIMITATIONS FOR SELECTED USES

'repared for: Killearn Lakes Waste Water Disposal Study Unit I Prepared by: Candace Trimble Date: 4-9-87

Soil name and map symbol	RELEVANT SOIL PROPERTIES 1/					DEGREE AND NATURE OF LIMITATION 1/				
	Depth to expected seasonal high water table	Flood Hazard (wetness)	Permeability (most restrictive layer) (in/hr)	Texture (various depths to 60")	Slope	Septic tanks	Soil Hydrologic Group	Low buildings roads and streets		Wetland Plants
16 'linthic 'aleudult approx ot x - 105)	6.0 ft.	None	0.6-2.0* (10-65")	sandy loam (0-10") sandy clay loam (10-65")	2-5%	Severe (2,3,4)	B	Moderate (2,4)		
	(water table: soil saturated at 12"; water table indicators occur at 23")									
	Sheet flow and seepage from lot T- 3&4 accross to lot x-104 & 105									
10 Dothan (approx, lot x-113)	3.0-5.0ft perched Jan-Apr.	None	0.6-2.0 (30"+)	loamy sand (0-17) sandy clay (17-30") sandy clay loam (30-55")	2-5%	Severe (2,3,4)	B	Moderate (4)		
	(Water table: soil saturated at 20"; water table indicators at 55")									

Nature of Limitation: 1. Slope 2. Wetness 3. Percs slowly 4. Surface runoff

1/ Data shown only for properties most relevant to the planned land use.

Soils rated as SLIGHT have few or no limitations for the use. Soils rated as MODERATE have limitations that reduce to some degree their desirability for the purpose being considered. They require some corrective measures. Soils rated as SEVERE have unfavorable soil properties or features that severely restrict their use and desirability for the purpose of major soil reclamation, special design, or intensive maintenance is required.

*Estimated permeability - No previous sampling data available - estimate based on subsoil texture.

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MAJOR SOIL PROPERTIES, DEGREE AND NATURE OF LIMITATIONS FOR SELECTED USES

'repared for: Killearn Lakes Waste Water Disposal Study Unit I Prepared by: Candace Trimble Date: 4-9-87

Soil name and map symbol	RELEVANT SOIL PROPERTIES 1/					DEGREE AND NATURE OF LIMITATION 1/				
	Depth to expected seasonal high water table	Flood Hazard (wetness)	Permeability (most restrictive layer) (in/hr)	Texture (various depths to 60")	Slope	Septic tanks	Soil Hydrologic Group	Low buildings roads and streets	[illegible]	Wetland Plants
16 Fuquay (approx. lot x-121 x 122)	2.5-4.0 Perched Jan-Mar	None	0.06-0.2 (45"+)	loamy fine sandy (0-28") sandy loam (28-34") sandy clay loam (34-60")	0-5%	Moderate (3)	B	Slight		
	(water table: none observed: water table indicators occur at 60".)									
11 Dothan (approx. lot x-127)	3.0-5.0ft perched Jan-Arp.	None	0.6-2.0 (19"+)	loamy fine sand (0-14") fine sandy loam (14-19") sandy clay loam (19-55")	5-8%	Severe (2,3,4)	B	Moderate (1,4)		
	(water table" soil saturated at 34": water table indicators between 50 & 55".)									

ature of Limitation: 1. Slope 2. Wetness 3. Percs slowly 4. Surface runoff.

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MAJOR SOIL PROPERTIES, DEGREE AND NATURE OF LIMITATIONS FOR SELECTED USES

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Soil name and map symbol	RELEVANT SOIL PROPERTIES 1/					DEGREE AND NATURE OF LIMITATION 1/				
	Depth to expected seasonal high water table	Flood Hazard (wetness	Permeability (most restrictive layer) (in/hr)	Texture (various depths to 60")	Slope	Septic tanks	Soil Hydrologic Group	Low buildings roads and streets		Wetland Plants
33 Orangeburg (approx. lot x-8)	>6.0 ft.	None	0.6-2.0 (12"+)	fine sandy loam (0-7") sandy loam (7-12") sandy clay loam (12-64")	2-5%	Slight	B	Slight		
	(Water table: none observed; no indicators)									
11 Dothan (approx. lot x-16)	3.0-5.0 ft perched Jan-Apr.	None	0.6-2.0 (20"+)	Loamy sand (0-17") sandy loam (17-20") sandy clay loam (20-23") sandy loam (23-26") sandy clay loam (26-50")	5-8%	Severe (2,3,4)	B	Moderate (1,4)		
	(water table: none observed; no indicators above 48")									

Nature of Limitation: 1. Slope 2. Wetness 3. Percs slowly 4. Surface runoff

1/ Data shown only for properties most relevant to the planned land use.

Soils rated as SLIGHT have few or no limitations for the use. Soils rated as MODERATE have limitations that reduce to some degree their desirability for the purpose being considered. They require some corrective measures. Soils rated as SEVERE have unfavorable soil properties or features that severely restrict their use and desirability for the purpose of major soil reclamation, special design, or intensive maintenance is required.

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MAJOR SOIL PROPERTIES, DEGREE AND NATURE OF LIMITATIONS FOR SELECTED USES

Prepared for: Killearn Lakes Waste Water Disposal Study Unit I Prepared by: Candace Trimble Date: 4-9-87

Soil name and map symbol	RELEVANT SOIL PROPERTIES 1/					DEGREE AND NATURE OF LIMITATION 1/				
	Depth to expected seasonal high water table	Flood Hazard (wetness)	Permeability (most restrictive layer) (in/hr)	Texture (various depths to 60")	Slope	Septic tanks	Soil Hydrologic Group	Low buildings roads and streets		Wetland Plants
11 Dothan (approx. lot x-20)	3.0-5.0 ft perched Jan-Apr.	None	0.6-2.0 (30" +)	loamy fine sand (0-20") sandy loam (20-30") sandy clay loam (30-48")	5-8%	Severe (2,3,4)	B	Moderate (1,4)		
	(water table: none observed; no indicator above 48")									
Typic Paleudult (clayey) (approx. lot x-25)	1.5-2.5ft* Apparant Nov-Apr.	None	.06 * (0"+)	sandy clay (0-48")	5-8%	Severe (2,3,4)	D	Severe (1,2,4,5)		Present in pond at back of lot.
	(water table" soil saturated at 30"; water table indicators at 24")									

Nature of Limitation: 1. Slope 2. Wetness 3. percs slowly 4. Surface runoff 5. slipage

1/ Data shown only for properties most relevant to the planned land use.

Soils rated as SLIGHT have few or no limitations for the use. Soils rated as MODERATE have limitations that reduce to some degree their desirability for the purpose being considered. They require some corrective measures. Soils rated as SEVERE have unfavorable soil properties or features that severely restrict their use and desirability for the purpose of major soil reclamation, special design, or intensive maintenance is required.

*Permeability and water table duration estimated based on soil indicators, vegetation & soil texture.

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MAJOR SOIL PROPERTIES, DEGREE AND NATURE OF LIMITATIONS FOR SELECTED USES

Prepared for: Killearn Lakes Waste Water Disposal Study Unit I Prepared by: Candace Trimble Date: 4-9-87

Soil name and map symbol	RELEVANT SOIL PROPERTIES 1/					DEGREE AND NATURE OF LIMITATION 1/				
	Depth to expected seasonal high water table	Flood Hazard (wetness)	Permeability (most restrictive layer) (in/hr)	Texture (various depths to 60")	Slope	Septic tanks	Soil Hydrologic Group	Low buildings roads and streets		Wetland Plants
11 Dothan (approx. lot x-33)	3.0-5.0 ft perched Jan-Apr.	None	0.6-2.0 (25-48")	Loamy sand (0-19") sandy loam (19-25") sandy clay loam (25-48")	5-8%	Severe (2,3,4)	B	Moderate (1,4)		
	(Water table: soil saturated at 19"; water table indicators at 45")									
15 Fuquay (approx. lot x-48)	2.5-4.0' perched Jan-Mar.	None	0.06-0.20 (42"+)	loamy sand (0-30") sandy loam (30-42") sandy clay loam (42-48")	0-5%	Moderate (3)	B	Slight		
	(water table: no water table or indicators above 48")									

ature of Limitation: 1. Slope 2. Wetness 3 Percs slowly 4. Surface runoff

/ Data shown only for properties most relevant to the planned land use.

oils rated as SLIGHT have few or no limitations for the use. Soils rated as MODERATE have limitations hat reduce to some degree their desirability for the purpose being considered. They require some orrective measures. Soils rated as SEVERE have unfavorable soil properties or features that severely estrict their use and desirability for the purpose of major soil reclamation, special design, or ntensive maintenance is required.

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MAJOR SOIL PROPERTIES, DEGREE AND NATURE OF LIMITATIONS FOR SELECTED USES

repared for: Killearn Lakes Waste Water Disposal Study. Unit I Prepared by: Candace Trimble Date: 4-9-87

oil name nd map ymbol	RELEVANT SOIL PROPERTIES 1/					DEGREE AND NATURE OF LIMITATION 1/				
	Depth to expected seasonal high water table	Flood Hazard (wetness)	Permeability (most restrictive layer) (in/hr)	Texture (various depths to 60")	Slope	Septic tanks	Soil Hydrologic Group	Low buildings roads and streets		Wetland Plants
15 Fuquay (approx. lot x-58	2.5-4.0' perched Jan-Mar.	None	0.06-0.20 (43"+)	loamy sand (0-33") sandy loam (33-43") sandy clay loam (43"+)	0-5%	Moderate (3)	B	Slight		
(Water table: no water table observed: indicators at 43")										
15 Fuquay (approx. lot #65)	2.5-4.0' perched Jan-Mar.	None	0.06-0.20 (40"+)	loamy sand (0-30") sandy loam (30-40") sandy clay loam (40"+)	0-5%	Severe (2,3)	B	Moderate (2,4)		
(Water table: soil saturated-perched water table at 30-40";No indications to 50 in.)										

ture of Limitation: 1. Slope 2. Wetness 3. percs slowly 4. surface runoff

' Data shown only for properties most relevant to the planned land use.

ils rated as SLIGHT have few or no limitations for the use. Soils rated as MODERATE have limitations at reduce to some degree their desirability for the purpose being considered. They require some rrective measures. Soils rated as SEVERE have unfavorable soil properties or features that severely strict their use and desirability for the purpose of major soil reclamation, special design, or tensive maintenance is required.

NOTE: 60-62 natural surface drain inundated by stream overflow, also obvious wetlands

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MAJOR SOIL PROPERTIES, DEGREE AND NATURE OF LIMITATIONS FOR SELECTED USES

repared for: Killearn Lakes Waste Water Disposal Study Unit I Prepared by: Candace Trimble Date: 4-9-87

oil name nd map ymbol	RELEVANT SOIL PROPERTIES 1/					DEGREE AND NATURE OF LIMITATION 1/				
	Depth to expected seasonal high water table	Flood Hazard (wetness)	Permeability (most restrictive layer) (in/hr)	Texture (various depths to 60")	Slope	Septic tanks	Soil Hydrologic Group	Low buildings roads and streets		Wetland Plants
52 Yonges (approx. lot #x-72)	0-1.0 ft. apparent Nov-Apr.	Frequent long duration Nov.-Mar.	0.6-2.0 (71-80")	Fine sandy loam (0-9") sandy clay (9+")	0-2%	Severe (2,3,6)	D	Severe (2,6,7)		Wetland vegetation present
(Water table: saturated to surface; water table indicators predict surface water table.)										
10 Dothan (apprpx. lot #x-71	3-5ft perched Jan.-Apr.	None	0.2-0.6	----	2-5%	Severe (2,3,4)	B	Moderate (2,4)		
(Checked 1st investigations---no wetness indicators with 48" -- observed water table well above that indicated by soil profile.)										

ture of Limitation: 1. Slope 2. Wetness 3. percs slowly 4. Surface runoff 5. Slipage 6. Floods 7. low strength

1/ Data shown only for properties most relevant to the planned land use.

ils rated as SLIGHT have few or no limitations for the use. Soils rated as MODERATE have limitations at reduce to some degree their desirability for the purpose being considered. They require some rrective measures. Soils rated as SEVERE have unfavorable soil properties or features that severely strict their use and desirability for the purpose of major soil reclamation, special design, or tensive maintenance is required.

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MAJOR SOIL PROPERTIES, DEGREE AND NATURE OF LIMITATIONS FOR SELECTED USES

repared for: Killearn Lakes Waste Water Disposal Study Unit I Prepared by: Candace Trimble Date: 4-23-87

oil name nd map ymbol	RELEVANT SOIL PROPERTIES 1/					DEGREE AND NATURE OF LIMITATION 1/				
	Depth to expected seasonal high water table	Flood Hazard (wetness	Permeability (most restrictive layer) (in/hr)	Texture (various depths to 60")	Slope	Septic tanks	Soil Hydrologic Group	Low buildings roads and streets	[illegible]	Wetland Plants
11 Dothan Clarendon (approx lot R-9)	3.0-5.0 perched Jan-Apr. (Wetness	NNne mottles	0.2-0.6 (42"+) 30-32", soil	Loamy sand (0-17" sandy clay loam (17-48") saturated	2-5% at 40")	Severe (2,3,4)	B	Slight		
Typic Hapludult (approx. lot R-17)	> 6 ft.	None	0.6-0.2 (30"+)	loamy sand (0-16") sandy clay loam (16-30") sandy clay (30-48") (Parent Material)	0-5%	Severe (3,4)	C	Slight		
	(No wetness or indicators, however culvert discharging effluent onto lot from lots across street and upslope.)									

ıture of Limitation: 1. Slope 2. Wetness 3. Percs slowly 4. Surface runoff 5. Slipage

/ Data shown only for properties most relevant to the planned land use.

›ils rated as SLIGHT have few or no limitations for the use. Soils rated as MODERATE have limitations ıat reduce to some degree their desirability for the purpose being considered. They require some ›rrective measures. Soils rated as SEVERE have unfavorable soil properties or features that severely ɛstrict their use and desirability for the purpose of major soil reclamation, special design, or ıtensive maintenance is required.

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MAJOR SOIL PROPERTIES, DEGREE AND NATURE OF LIMITATIONS FOR SELECTED USES

Prepared for: Killearn Lakes Waste Water Disposal Study Unit I Prepared by: Candace Trimble Date: 4-24-87

Soil name and map symbol	RELEVANT SOIL PROPERTIES 1/					DEGREE AND NATURE OF LIMITATION 1/				
	Depth to expected seasonal high water table	Flood Hazard (wetness)	Permeability (most restrictive layer) (in/hr)	Texture (various depths to 60")	Slope	Septic tanks	Soil Hydrologic Group	Low buildings roads and streets		Wetland Plants
Plinthic Hapludult (approx. lot R-20)	> 6 ft.	None	0.06-0.2 (20" +)	loamy sand (0-28") sandy clay (28"+) Parent material	5-8%	Severe (3,4)	C	Slight		
Clarendon (approx. lots R-23-27)	1.5-2.5 apparent Dec.-Mar. (saturated at 11"	None	0.2-0.6 (38"+) mottled at 21"	loamy sand (0-15") sandy clay loam (15-38") sandy clay (38"+) - NOTE: culvert dumps onto R-23)	5-8%	Severe (2,3,4)	C	Moderate (2)		

ature of Limitation: 1. Slope 2. Wetness 3. Percs Slowly 4. Surface Runoff 5. Slipage

/ Data shown only for properties most relevant to the planned land use.

oils rated as SLIGHT have few or no limitations for the use. Soils rated as MODERATE have limitations hat reduce to some degree their desirability for the purpose being considered. They require some orrective measures. Soils rated as SEVERE have unfavorable soil properties or features that severely estrict their use and desirability for the purpose of major soil reclamation, special design, or ntensive maintenance is required.

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MAJOR SOIL PROPERTIES, DEGREE AND NATURE OF LIMITATIONS FOR SELECTED USES

epared for: Killearn Lakes Waste Water Disposal Study Unit I Prepared by: Candace Trimble Date: 4-24-87

il name d map mbol	RELEVANT SOIL PROPERTIES 1/					DEGREE AND NATURE OF LIMITATION 1/				
	Depth to expected seasonal high water table	Flood Hazard (wetness)	Permeability (most restrictive layer) (in/hr)	Texture (various depths to 60")	Slope	Septic tanks	Soil Hydrologic Group	Low buildings roads and streets		Wetland Plants
Fuquay (approx. lat lot Q-7)	2.5-4.0' perched Jan-Mar	None	0.06-0.2 (45"+)	loamy sand (0.25") sandy loam (25-32") sandy clay loam (32-48")	0-5%	Moderate (3)	B	Slight		
	(No wetness; no indicators within 48")									
Esto ? approx. lot Q-10)	>6 ft.	None	0.06-0.2 (26"+)	loamy sand (0-18") sandy clay loam (18-26") sandy clay (26-48")	5-8%	Severe (3)	B	Moderate (7)		

ture of Limitation: 1. Slope 2. Wetness 3. Percs slowly 4. Surface runoff 5. Slipage

Data shown only for properties most relevant to the planned land use.

ils rated as SLIGHT have few or no limitations for the use. Soils rated as MODERATE have limitations at reduce to some degree their desirability for the purpose being considered. They require some rrective measures. Soils rated as SEVERE have unfavorable soil properties or features that severely strict their use and desirability for the purpose of major soil reclamation, special design, or tensive maintenance is required.

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MAJOR SOIL PROPERTIES, DEGREE AND NATURE OF LIMITATIONS FOR SELECTED USES

Prepared for: Killearn Lakes Waste Water Disposal Study Unit I Prepared by: Candace Trimble Date: 4-24-87

Soil name and map symbol	RELEVANT SOIL PROPERTIES 1/					DEGREE AND NATURE OF LIMITATION 1/				
	Depth to expected seasonal high water table	Flood Hazard (wetness)	Permeability (most restrictive layer) (in/hr)	Texture (various depths to 60")	Slope	Septic tanks	Soil-Hydrologic Group	Low buildings roads and streets		Wetland Plants
10 Dothan (approx. lot -Q-15)	3.0-5.0 perched Jan.-Apr.	None	0.2-0.6 (22"+)	loamy sand (0-18") sandy loam (18-22") sandy clay loam (22-48")	2-5%	Severe (2,3)	B	Slight		
	(No wetness, no indicators)									
10 Dothan (approx. lot Q-21)	3.0-5.0' perched Jan-Apr.	None	0.2-0.6 (24"+)	loamy sand (0-16") sandy loam (16"-24") sandy clay loam (24-48")	2-5%	Severe (2,3)	B	Slight		
	(Soil saturated at 20 inches: no wetness indicators above 48 inches)									

Nature of Limitation: 1. Slope 2. Wetness 3. Percs slowly 4. Surface runoff 5. Slipage

1/ Data shown only for properties most relevant to the planned land use.

Soils rated as SLIGHT have few or no limitations for the use. Soils rated as MODERATE have limitations that reduce to some degree their desirability for the purpose being considered. They require some corrective measures. Soils rated as SEVERE have unfavorable soil properties or features that severely restrict their use and desirability for the purpose of major soil reclamation, special design, or intensive maintenance is required.

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MAJOR SOIL PROPERTIES, DEGREE AND NATURE OF LIMITATIONS FOR SELECTED USES

repared for: Killearn Lakes Waste Water Prepared by: Candace Trimble Date: 4-24-87

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oil name nd map ymbol	RELEVANT SOIL PROPERTIES 1/					DEGREE AND NATURE OF LIMITATION 1/				
	Depth to expected seasonal high water table	Flood Hazard (wetness	Permeability (most restrictive layer) (in/hr)	Texture (various depths to 60")	Slope	Septic tanks	Soil Hydrologic Group	Low buildings roads and streets		Wetland Plants
10 Dothan (approx. lot Q-25)	3.0-5.0' perched Jan-Apr. (No Wetness but indicators at 40")	None	0.2-0.6 (24"+)	loamy sand (0-6") sandy clay loam (6-48")	2-5%	Severe (2,3,4	B	Slight		
Bonneau (approx. lot Q-43-44)	3.5-5.0' apparent Dec.Mar. (No wetness or indicators within 48")	None	0.6-2.0 (32"+)	loamy sand (0-30") sandy loam (30-32") sandy clay loam (32-48")	0-5%	Moderate (2)	A	Slight		Evidence of standing water in center of lot about 2" above surface spaghrum Moss

ıture of Limitation: 1. Slope 2. Wetness 3. Perces Slowly 4. Surface runoff
5. Slipage 6. Floods
7. Low strength

' Data shown only for properties most relevant to the planned land use.

ɔils rated as SLIGHT have few or no limitations for the use. Soils rated as MODERATE have limitations ıat reduce to some degree their desirability for the purpose being considered. They require some ɔrrective measures. Soils rated as SEVERE have unfavorable soil properties or features that severely ɛstrict their use and desirability for the purpose of major soil reclamation, special design, or ıtensive maintenance is required.

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MAJOR SOIL PROPERTIES, DEGREE AND NATURE OF LIMITATIONS FOR SELECTED USES

repared for: Killearn Lkaes Waste Water Disposal Study Unit I Prepared by: Candace Trimble Date: 4-24-87

oil name nd map ymbol	RELEVANT SOIL PROPERTIES 1/					DEGREE AND NATURE OF LIMITATION 1/				
	Depth to expected seasonal high water table	Flood Hazard (wetness)	Permeability (most restrictive layer) (in/hr)	Texture (various depths to 60")	Slope	Septic tanks	Soil Hydrologic Group	Low buildings roads and streets		Wetland Plants
10 Dothan (approx. lot N-21)	3.0-5.0' perched Nov-Apr.	None	0.2-0.6 (25 " +)	Loamy sand (0-17") sandy loam (17-25") sandy clay loam (25-48")	2-5%	Severe (2,3,4)	B	Slight		
	(Soil saturated at 20", no wetness indicators above 48")									
10 Dothan (approx. lots- N-35,36)	3.0-5.0' perched Nov-Apr.	None	0.2-0.6 (23"+)	Loamy sand (0-17") sandy loam (17-23") sandy clay loam (23-48")	2-5%	Severe (2,3,4)	B	Slight		
	(No wetness indicators)									

ature of Limitation: 1. Slope 2. Wetness 3. percs slowly 4. surface runoff 5. slipage 6. Floods 7. Low strength

/ Data shown only for properties most relevant to the planned land use.

oils rated as SLIGHT have few or no limitations for the use. Soils rated as MODERATE have limitations hat reduce to some degree their desirability for the purpose being considered. They require some orrective measures. Soils rated as SEVERE have unfavorable soil properties or features that severely estrict their use and desirability for the purpose of major soil reclamation, special design, or ntensive maintenance is required.

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MAJOR SOIL PROPERTIES, DEGREE AND NATURE OF LIMITATIONS FOR SELECTED USES

epared for: Killearn Lakes Waste Water Prepared by: Candace Trimble Date: 4-24-87

Disposal Study
Unit I

il name d map mbol	RELEVANT SOIL PROPERTIES 1/					DEGREE AND NATURE OF LIMITATION 1/				
	Depth to expected seasonal high water table	Flood Hazard (wetness	Permeability (most restrictive layer) (in/hr)	Texture (various depths to 60")	Slope	Septic tanks	Soil Hydrologic Group	Low buildings roads and streets		Wetland Plants
10 Dothan approx. lot N-45-47)	3.0-5.0' perched Nov-Apr.	None	0.2-0.6 (22"+)	loamy sand (0-17") sandy loam (17-22") sandy clay loam (22-48")	2-5%	Severe (2,3,4)	B	Slight		
	(Saturated at 20', no indicator above 48")									
10 Dothan approx. lots N-48-59	3.0-5.0'	None	0.2-0.6		2-5%	Severe (2,3,4)	B	Slight		
	(all lots developed - expect water table consistent with N-45-47)									

ture of Limitation: 1. Slope 2. Wetness 3. Percs slowly 4. Surface runoff
5. Slipage 6. Floods
7. Low strength

Data shown only for properties most relevant to the planned land use.

ils rated as SLIGHT have few or no limitations for the use. Soils rated as MODERATE have limitations at reduce to some degree their desirability for the purpose being considered. They require some rrective measures. Soils rated as SEVERE have unfavorable soil properties or features that severely strict their use and desirability for the purpose of major soil reclamation, special design, or tensive maintenance is required.

MAJOR SOIL PROPERTIES, DEGREE AND NATURE OF LIMITATIONS FOR SELECTED USES

Prepared for: Killearn Lakes Waste Water Disposal Study Unit I Prepared by: Candace Trimble, D.C. Date: 4-30-87

Soil name and map symbol	RELEVANT SOIL PROPERTIES 1/					DEGREE AND NATURE OF LIMITATION 1/				
	Depth to seasonal high water table	Flood Hazard (wetness	Permeability (most restrictive layer) (in/hr)	Texture (various depths to 60")	Slope	Septic tanks	Soil Hydrologic Group	Low buildings roads and streets	Woodland Wildlife	Wetland Plants
10 Dothan (Approx lots P-40-41)	3.5-5.0ft Perched Jan-Apr.	None	0.6-2.0 (23"+)	Loamy sand (0-18") Sandy loam (18-23") Sandy clay loam (23"+)	2-5%	Severe (2,3)	B	Slight		
	(No wetness; no indicators within 48")									
10 Dothan (Approx lots P-30-35)	2.5-5.0ft Perched Jan-Apr.	None			2-5%	Severe (2,3,4)	B	Moderate (4)		
	Water table: saturated at 20" on 3-5-87, wetness indicators at 48".									

Nature of Limitation: 1. Slope 2. Wetness 3. Perces slowly 4. Surface runoff

1/ Data shown only for properties most relevant to the planned land use.

Soils rated as SLIGHT have few or no limitations for the use. Soils rated as MODERATE have limitations that reduce to some degree their desirability for the purpose being considered. They require some corrective measures. Soils rated as SEVERE have unfavorable soil properties or features that severely restrict their use and desirability for the purpose of major soil reclamation, special design, or intensive maintenance is required.

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MAJOR SOIL PROPERTIES, DEGREE AND NATURE OF LIMITATIONS FOR SELECTED USES

Prepared for: Killearn Lakes Waste Water Disposal Study Unit I Prepared by: Candace Trimble Date: 4-30-87

Soil name and map symbol	RELEVANT SOIL PROPERTIES 1/					DEGREE AND NATURE OF LIMITATION 1/				
	Depth to seasonal high water table	Flood Hazard (wetness)	Permeability (most restrictive layer) (in/hr)	Texture (various depths to 60")	Slope	Septic tanks	Soil Hydrologic Group	Low buildings roads and streets	Woodland Wildlife	Wetland Plants
Dunbar ? Aeric Paleaqult (Approx. lot P-10)	1-2.5ft	None	0.2-0.6 (18"+)	loamy sand (0-3") Sandy clay Loam (3-18") Sandy clay (18-48")	5-8%	Severe (2,3)	D	Severe (2,7)		
	Water table: Saturated at 40" - indicators at 20" only ½" rain in last 30 days can expect water table at 20" above during high rainfall)									
10 Dothan (Approx lot P47-48)	3-5ft	None	0.6-2.0 (23"+)	loamy sand (0-18") sandy clay (18-23") sandy clay loam 23"+)	2-5%	Severe (2,3)	B	Slight		
	Water table" Saturated at 20" 3/5/87; indicator 40-48". We were unable to bore with desired frequency in Block P due to extent of development; All indicators show Block P predominately Dothan soils)									

Nature of Limitation: 1. Slope 2. Wetness 3. Percs slowly 4. Surface runoff 5. Slipage 6. Floods 7. low strength

1/ Data shown only for properties most relevant to the planned land use.

Soils rated as SLIGHT have few or no limitations for the use. Soils rated as MODERATE have limitations that reduce to some degree their desirability for the purpose being considered. They require some corrective measures. Soils rated as SEVERE have unfavorable soil properties or features that severely restrict their use and desirability for the purpose of major soil reclamation, special design, or intensive maintenance is required.

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MAJOR SOIL PROPERTIES, DEGREE AND NATURE OF LIMITATIONS FOR SELECTED USES

Prepared for: Killearn Lakes Waste Water Disposal Study. Unit II Prepared by: Candace Trimble Date: 4-30-87

Soil name and map symbol	RELEVANT SOIL PROPERTIES 1/					DEGREE AND NATURE OF LIMITATION 1/				
	Depth to seasonal high water table	Flood Hazard (wetness	Permeability (most restrictive layer) (in/hr)	Texture (various depths to 60")	Slope	Septic tanks	Soil Hydrologic Group	Low buildings roads and streets	Woodland Wildlife	Wetland Plants
50 Wagram (Approx lots AC-2-3)	6ft	None	0.6-2.0 (35"+)	Loamy sand (0-35") Sandy Clay loam (35-48")	2-5%	Slight	A	Slight		
	Water table: no wetness; no indicators above 48".									
33 Orangeburg (Approx lots AE-5-9 AC-7 AO-8-12)	6 ft	None	0.6-2.0 (5"+)	sandy loam (0-5") Sandy clay loam (5"+)	0-5%	Moderate (3)	B	Slight		
	Water table: no wetness; no indicators to 48".									

Nature of Limitation: 1. Slope 2. Wetness 3. Perces slowly 4. Surface runoff

1/ Data shown only for properties most relevant to the planned land use.

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MAJOR SOIL PROPERTIES, DEGREE AND NATURE OF LIMITATIONS FOR SELECTED USES

Prepared for: Killearn Lakes Waste Water Disposal Study. Unit II Prepared by: Candace Trimble, D.C. Date: 4-30-87

Soil name and map symbol	RELEVANT SOIL PROPERTIES 1/					DEGREE AND NATURE OF LIMITATION 1/				
	Depth to seasonal high water table	Flood Hazard (wetness	Permeability (most restrictive layer) (in/hr)	Texture (various depths to 60")	Slope	Septic tanks	Soil Hydrologic Group	Low buildings roads and streets	Woodland Wildlife	Wetland Plants
33 Orangeburg (Approx lot AD-15)	>6 ft	None	0.6-2.0 (20"+)	Sandy loam (0-20") Sandy clay loam (20"+)	0-5%	Moderate (3)	B	Slight		
	Water table no wetness; no indicators to 48"									
34 Orangeburg (Approx lots AE-12-16)	>6 ft	None	0.6-2.0	Sandy loam (0-15") Sandy clay Loam (15+)	5-8%	Moderate (3)	B	Slight		
	Water table: no wetness no indicators.									

Nature of Limitation: 1. Slope 2. Wetness 3. Perces slowly 4. Surface runoff.

1/ Data shown only for properties *most* relevant to the planned land use.

Soils rated as SLIGHT have few or no limitations for the use. Soils rated as MODERATE have limitations that reduce to some degree their desirability for the purpose being considered. They require some corrective measures. Soils rated as SEVERE have unfavorable soil properties or features that severely restrict their use and desirability for the purpose of major soil reclamation, special design, or intensive maintenance is required.

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FB-CONS 10
USDA-SCS
10/73

MAJOR SOIL PROPERTIES, DEGREE AND NATURE OF LIMITATIONS FOR SELECTED USES

Prepared for: Killearn Lakes Waste Water Disposal Study Unit II Prepared by: Candace Trimble, D.C. Date: 4-30-87

Soil name and map symbol	RELEVANT SOIL PROPERTIES 1/					DEGREE AND NATURE OF LIMITATION 1/				
	Depth to seasonal high water table	Flood Hazard (wetness	Permeability (most restrictive layer) (in/hr)	Texture (various depths to 60")	Slope	Septic tanks	Soil Hydrologic Group	Low buildings roads and streets	Woodland Wildlife	Wetland Plants
34 Orangeburg (Approx lot AC-11	>6 FT	None	0.6-2.0 (11"+)	Sandy loam (0-11") Sandy clay loam (11"+)	5-8%	Moderate (1,3,4)	B	Slight		
	Water Table: No wetness; no indicators for 48"									
34 Orangeburg (Approx lots AH-13-15) AG-4-17) AI-4-17)	>6 ft	None	0.6-2.0 (7"+)	Sandy loam (0-7") Sandy clay Loam (7"+)	5-8%	Moderate (1,3,4)	B	Slight		
	Water table: No wetness; no indicaters to 48".									

Nature of Limitation: 1. Slope 2. Wetness 3. Percs Slowly 4. Surface runoff

1/ Data shown only for properties most relevant to the planned land use.

Soils rated as SLIGHT have few or no limitations for the use. Soils rated as MODERATE have limitations that reduce to some degree their desirability for the purpose being considered. They require some corrective measures. Soils rated as SEVERE have unfavorable soil properties or features that severely restrict their use and desirability for the purpose of major soil reclamation, special design, or intensive maintenance is required.

Attachment # 2
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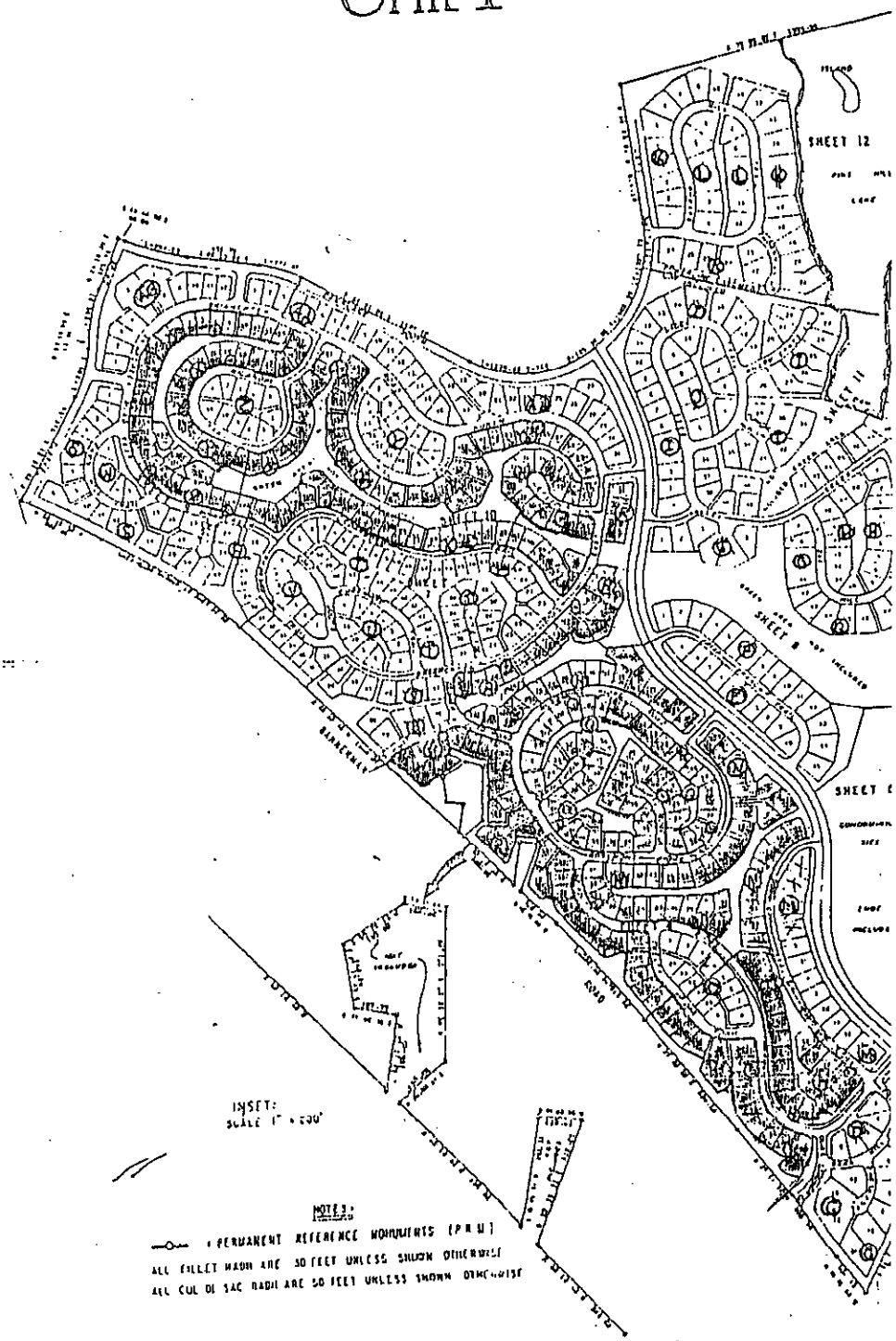
MAPS

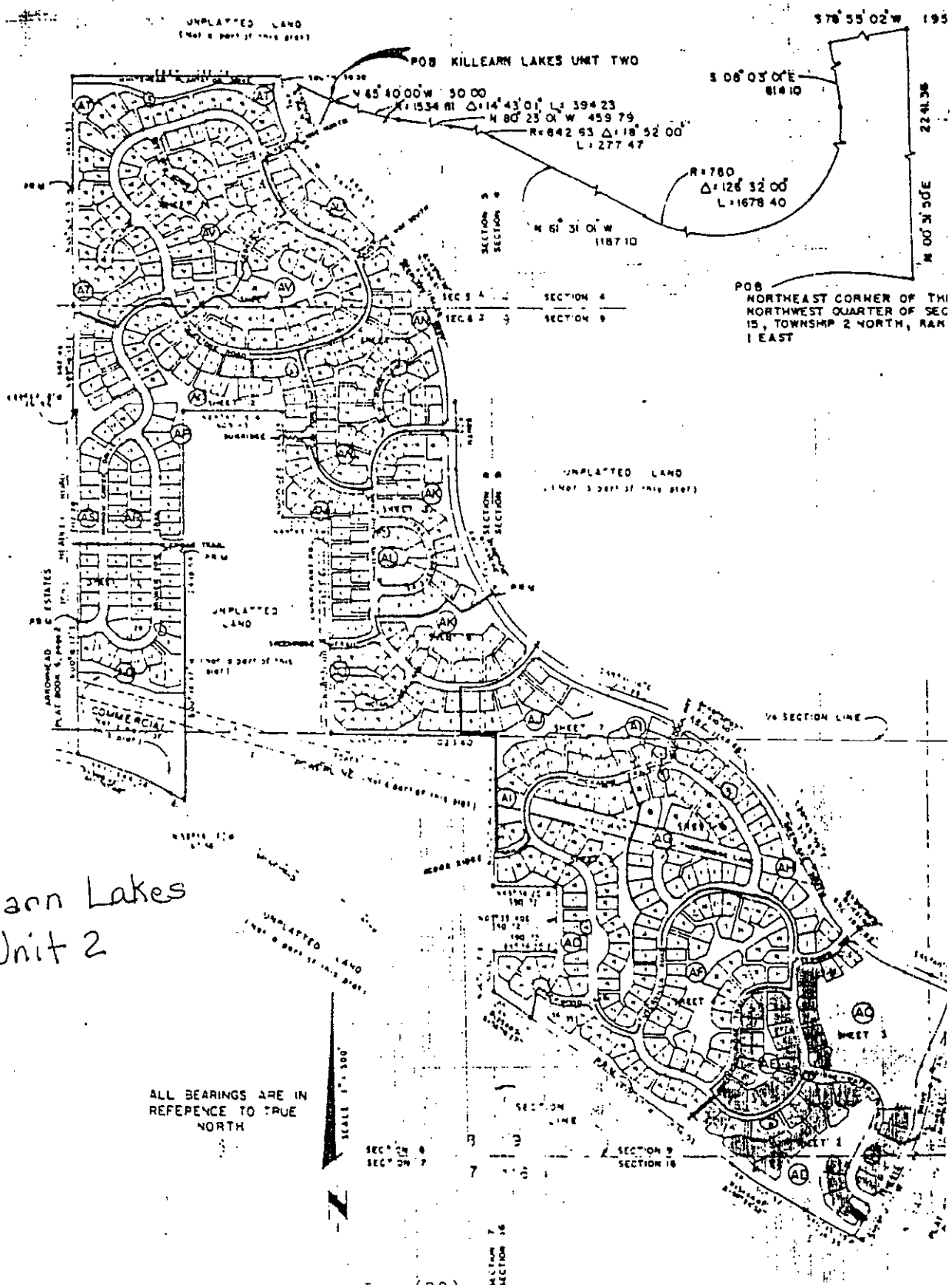
KILLEARN LAKES UNIT I

KILLEARN LAKES UNIT II

Killearn Lakes

Unit 1





Killearn Lakes
Unit 2

NORTHWEST FLORIDA WATER MANAGEMENT DISTRICT

M E M O R A N D U M

TO: Mr. Douglas E. Barr, Director, Water Resources Division

FROM: Agustin E. Maristany, P. E., Senior Hydrologist

DATE: June 3, 1987

SUBJECT: Stormwater Drainage in Killearn Lakes

INTRODUCTION

In response to a request for technical assistance from Leon County, a preliminary evaluation of the stormwater drainage problems in Unit I of Killearn Lakes was performed. In addition, the impact of stormwater on septic tank operations was addressed. The evaluation was based on data extrapolated from other watersheds in Leon County, since no specific hydrologic data for the area was available. Given the unique "sheet-flow" drainage system of that development, the extrapolated results should be considered preliminary pending completion of additional site-specific evaluations.

The analysis performed herein was deemed appropriate for the conceptual evaluation of the stormwater drainage problems and potential solutions. However, a more detailed analysis should be conducted prior to any final design and construction in order to determine the actual cost and correct sizing of any improvements to the drainage system.

STUDY AREA

The study area includes most of Killearn Lakes' Unit I, as defined by the watershed area drained by the last two half-culverts located under Kinhega Drive. The total drainage area is approximately 225.44 acres with an average main-channel slope of 1.9%. The current level of percent imperviousness was estimated at 20% based on about 500 developed lots from a maximum of 750 lots. The built-out impervious level would be approximately 35%.

The existing drainage system is very close to natural conditions with a minimum of improvements except for the roads and residential structures. The roads generally follow the topographic contours with a minimum of

channel crossings. The design is based on the "sheet-flow" concept which allows for stormwaters to flow along the natural land contours to the main discharge channel. Although the "sheet-flow" system is environmentally attractive due to its minimum impact on peak flows, runoff volumes, and water quality, it causes undesirable results in areas with poorly drained soils and high water tables as is the case in Killearn Lakes' Unit I.

HYDROLOGY

In general, increased development results in increased peak flows, higher runoff volumes, and poor stormwater quality. The increase in impervious area surfaces reduces the land area available for infiltration, resulting in greater runoff volumes. At the same time, improvements such as swales and/or storm sewers shorten the time of concentration in the developed area by increasing the speed of travel of stormwater runoff. This has the effect of producing both higher peak flows due to faster throughput, and higher volumes due to a reduction in the time available for rain waters to infiltrate. The degradation in water quality results from the flushing of pollutants generated by human activities.

In contrast to the typical drainage system, a "sheet-flow" system allows for maximum contact of runoff waters with pervious surfaces, thus slowing stormwater runoff, increasing infiltration, and lessening the impact on water quality. The excess stormwater volume generated from impervious surfaces is directed to the pervious areas where a portion is infiltrated and the rest flows overland as sheet flow. Whereas a typical drainage system directs excess stormwaters away from improved properties in a controlled fashion, the "sheet-flow" system allows uncontrolled runoff over yards, having a maximum impact on properties located the farthest downstream.

Based on regional flood equations developed by the U. S. Geological Survey for Leon County (USGS, 1984), estimates of flood volumes and peak flows were computed for the study area defined above. The equations were developed from data on fifteen watersheds in the vicinity of the City of Tallahassee. Since the equations were developed for watersheds having standard drainage systems (swales and/or sewers) instead of "sheet-flow" systems, the flood estimates will only be accurate for low levels of development, with the accuracy diminishing with increasing levels of development. The actual impact of increased development on the "sheet-flow" drainage will be somewhat less for the reasons discussed above.

The following two tables give the peak flows (in cubic feet per second or "cfs") and runoff volumes (in inches) associated with various size storms. The numbers in parenthesis give the ratio of post-development to pre-development flows and volumes.

PEAK FLOWS (CFS) FOR GIVEN PERCENT IMPERVIOUSNESS

RETURN PERIOD (YRS)	PERCENT IMPERVIOUS 0%	20%	35%
2	4.8	118	215
		(25)	(45)
5	11.0	185	313
		(17)	(28)
10	17.4	234	379
		(13)	(22)
25	27.8	297	463
		(11)	(17)
50	38.3	347	524
		(9)	(14)
100	50.8	398	584
		(8)	(12)
500	91.3	533	741
		(6)	(8)

FLOOD VOLUMES (IN) FOR GIVEN PERCENT IMPERVIOUSNESS

RETURN PERIOD (YRS)	PERCENT IMPERVIOUS 0%	20%	35%
2	0.33	1.43	1.88
		(4.3)	(5.7)
5	0.66	2.25	2.84
		(3.4)	(4.3)
10	0.95	2.79	3.42
		(2.9)	(3.6)
25	1.42	3.70	4.43
		(2.6)	(3.1)
50	1.84	4.39	5.16
		(2.4)	(2.8)
100	2.32	5.06	5.84
		(2.2)	(2.5)
500	3.72	6.98	7.84
		(1.9)	(2.1)

The tables give a good indication of the impact that increased development has on flood flows and volumes. The greatest impact is on flood flows with low return periods. The 2-year post-development peak flow for 20% impervious, for example, is 25 times greater than pre-development, so that it responds like a 500-year pre-development storm. Similar results

were obtained for flood volumes, indicating that a 2-year post-development volume for 20% impervious would be equivalent to a 25-year pre-development volume. In summary, increased development augments the frequency of occurrence of damaging storm events. What used to be a 500-year peak flow storm, is now experienced about 250 times more often, or once every two years. Likewise, the 25-year storm volume now occurs 13 times more frequently.

HYDRAULICS

Given the higher flows expected as a result of increased development, a quick estimate was computed for the capacity of the two half-culverts located under Kinhega Drive. A couple of simplifying assumptions were necessary in order to expedite the calculations. It was assumed that no storage is available at the upstream end of the culverts so that the peak flows tabulated above would not be attenuated. In addition, the water level at the downstream end of the culverts was taken equal to the top of the culverts, assuming no backwater restrictions to flow. Whereas the first assumption may result in higher water levels than actual conditions, the second assumption compensates by producing lower levels than would actually occur.

The following table gives the depth of water above the bottom of the culverts for various size storms:

DEPTH OF WATER ABOVE BOTTOM OF CULVERTS (FEET)

RETURN PERIOD (YRS)	PERCENT IMPERVIOUS 0%	20%	35%
2	2	8.6	23.7
5	2	18.0	47.8
10	2.1	>18.0	>47.8
25	2.4		
50	2.7		
100	3.2		
500	5.9		

The results indicate that whereas the capacity of the culverts is sufficient to handle most storms under undeveloped conditions, they seem to pose restrictions to flows under present and anticipated levels of development, with potential to overtop the road and cause excessive water levels and flooding upstream. The results indicate that a more detailed analysis is necessary to better define the risk of flooding due to limited culvert capacity.

IMPACT OF DEVELOPMENT ON SEPTIC TANK OPERATIONS

In the case of a "sheet-flow" drainage system, the increased flows and volumes generated by upstream development are received by downstream property owners whose drainage problems worsen as development increases. Since more water now flows over downstream properties, a larger volume of water infiltrates into pervious areas, thus causing a general rise in water table elevations and creating a potential problem with the operation of septic tanks. The impact on the water table may be subdivided into two categories: the long- and short-term effects.

The long-term impact consists of a rise in the average water table elevation resulting from a reduction in the watershed area available for infiltration and evapotranspiration. Whereas rainfall occurs over the entire watershed, evapotranspiration and infiltration only affect the pervious areas. An indication of the magnitude of the water table rise may be obtained by examining the changes in evapotranspiration (ET) due to development. The average annual rate of ET for a rural area is about 35 inches (Maristany, 1983). However, for an area with 20% impervious surface, the effective rate would be reduced to 80% of the 35 inches or 28 inches. The difference of seven inches will tend to infiltrate into the remaining 80% pervious surfaces, resulting in a net increase in infiltration volume of about 8.8 inches. Assuming a soil porosity of 25%, this volume is equivalent to a rise of 35.2 inches or almost three feet in water table elevation. Similar computations for a 35% impervious area, or built-out conditions in Unit I, indicate a potential for the water table to rise as much as six feet above the normal pre-development levels. These impacts represent the maximum increase possible just due to a reduction in ET over the watershed. Smaller increases would result for areas having higher soil permeabilities and steeper slopes.

In addition to the permanent changes in average water table elevations indicated above, further increases will also occur on a short-term basis due to storm activity. Although it is normal to expect water levels to rise in response to rain storms, development will cause the rise to be even more pronounced. As discussed previously, the excess runoff from impervious areas will increase the volume of water that percolates into the open or pervious areas.

To estimate the temporary rise in water table elevations that would result from increased urbanization using the "sheet-flow" system, a preliminary estimate was prepared for the volume of infiltration resulting from different size rain storms. It was assumed that all of the excess runoff volume due to development would be completely infiltrated into the pervious areas. This assumption would tend to over estimate the volume of infiltration in the upstream areas but would yield more accurate results for the downstream properties bordering the green areas which receive most of the "sheet-flow" runoff.

The purpose of the evaluation was to estimate the frequency with which short-term changes in water levels would occur under different levels of development. The basis for the frequency computations was a statistical analysis of historic daily rainfall data at the NOAA station in Tallahassee for the period 1930 to 1980. Daily rainfall data was converted to daily infiltration volumes by subtracting runoff volumes computed using the rational method. The runoff coefficient (C) used was calculated for a 2-year storm event from rainfall data and the flow data previously tabulated. Conversion of infiltration volumes to depths of water table was performed using a soil porosity of 25%.

The following table gives the percent of time that short-term increases in water table would occur in response to rain storm activity. These increases would be superimposed over the permanent water table increases discussed previously. The numbers in parenthesis indicate how many times more often the given change in water table occurs as compared to pre-development conditions.

PERCENT OF TIME EQUALLED OR EXCEEDED

WATER TABLE CHANGE (IN)	PERCENT IMPERVIOUS 0%	20%	35%
10	0.8	2.3 (2.9)	3.7 (4.6)
15	0.2	0.9 (4.5)	1.6 (8.0)
20	0.06	0.33 (5.0)	0.7 (11.7)
25	0.02	0.13 (6.5)	0.4 (20.0)
30	0.01	0.05 (5.0)	0.18 (18.0)

The table indicates that an increase of ten inches in the water table would naturally take place about 0.8% of the time or about three times per year under pre-development conditions. In contrast, an increase in

development to 20% impervious would cause that same increase in water table to occur 2.9 times more often or 8.4 times per year. As development approaches built-out conditions (35% impervious), the increase will occur 4.6 times more often or 13.5 times per year, on the average. These figures may be translated into the frequency of incidence of septic tank problems. If the post-development average water table at a particular location occurs at about ten inches below the ground surface, septic tank problems would be expected to occur at least 2.9 times more often under current impervious levels and aggravate to at least 4.6 times more often as the area becomes fully developed.

One of the alternatives proposed for resolving the septic tank problems was the installation of french drains or swales intended to lower the water table in individual lots. To evaluate the effectiveness of that option, an analysis was performed to estimate the amount of water that such a system would drain from each lot given the type of soils in the area. An average size lot of 1/4 acre was used, and swales were designed along its entire perimeter. The average distance from the center of the lot to the nearest swale was estimated at 50 feet, and the bottom of the swales was assumed to penetrate three feet into the ground surface. Assuming that the soil profile is completely saturated, and using a soil permeability of 0.6 feet per day, the rate at which the swales would drain the lot was computed at 0.002 feet per day. In comparison, the average rate of evapotranspiration is about 0.008 feet per day, while the average daily rate of septic tank outflow is about 0.0034 feet per day over a 1/4 acre lot. Accordingly, evapotranspiration is four times more effective at lowering the water table than the proposed alternative and is more than enough to offset the discharge from septic tanks. This explains the lack of septic tank problems during dry periods.

Given the results presented above, it is clear that the successful operation of septic tank drainfields is almost exclusively a function of available soil storage above the water table and not the capacity of the soil to move water. Under these circumstances, the successful operation of the drainfields is rendered extremely sensitive to development activities, particularly as a result of the "sheet-flow" drainage system used in the area which causes pronounced increases in water table elevations. Accordingly, percolation tests are of very limited value for determining the suitability of sites for septic tank installation. Also, the practice of measuring water table elevations prior to development are lacking, since significant increases in water levels are expected to occur due to development pressures. The need exists to develop a more accurate methodology for determining the suitability of areas to accommodate septic tank systems.

CONCLUSIONS

The preliminary evaluation conducted herein provides sufficient technical evidence that the "sheet-flow" drainage system used in Killearn Lakes' Unit I causes both drainage and septic tank problems to downstream properties which receive all the excess flood waters generated from impervious areas upstream. In addition, the two culverts which drain the area under Kinhega Drive do not seem to have sufficient capacity to carry flood waters and, consequently, have the potential to create excessive water levels and flooding upstream. The excess runoff generated from impervious areas collects and flows through downstream properties located along naturally occurring valleys. This uncontrolled drainage results in excessive erosion, the occurrence of seeps, and flooding.

In addition to the surface water impacts, the "sheet-flow" system was found to cause average water tables to rise as much as three to six feet for current and built-out conditions, respectively. Also, the temporary rise in water table due to rain storm activity was found to be more pronounced as a direct result of development, causing septic tank failures to occur at least three to eight times more often when post-development water table depths are relatively shallow.

These conclusions agree well with findings from a survey conducted by the Killearn Homeowner's Association which indicates that of about 290 residents polled, approximately 50% claimed to have had drainage problems and 33% claimed to have had septic tank problems. Also, the residents have indicated that the incidence and severity of the problems have been particularly pronounced in recent years as development levels have approached built-out conditions. The information presented in this evaluation underscores the connection between drainage and septic tank problems.

RECOMMENDATIONS

Given the frequency and severity of the problems and the fact that the situation will worsen as the area becomes more fully developed, it is recommended that the drainage system be improved to route excess waters away from downstream properties. This action is also expected to help reduce the incidence of septic tank problems, although it is not possible to determine its effectiveness from available data. A more detailed analysis will be required to determine the most effective approach to resolving the drainage issue. In addition, the possible enlargement of the culverts under Kinhega Drive will cause higher flows downstream, thus necessitating further study of the downstream impacts.

Given that the northeast sections of the county lie within a high-growth corridor, it would be advisable to develop a long-term plan for the area in order to prevent problems like those described above from occurring. Such a plan should address both stormwater and sewage disposal issues.

Further study is also required to develop a more accurate methodology for determining the suitability of large areas to accommodate septic tanks. The current techniques fail to account for the substantial impact that development has on water table elevations and percolation rates.

REFERENCES

Franklin, M. A., 1984, Magnitude and Frequency of Floods from Urban Streams in Leon County, Florida; Water-Resources Investigations Report 84-4004, U. S. Geological Survey.

Franklin, M. A., 1984, Magnitude and Frequency of Flood Volumes from Urban Watersheds in Leon County, Florida; Water-Resources Investigations Report 84-4003, U. S. Geological Survey.

Maristany A. E., 1983, Surface Water Assessment of the Little River Basin, Northwest Florida; Northwest Florida Water Management District Special Report 83-2.

AEM/lb

SURFACE WATER POLLUTION SURVEY
KILLEARN LAKES UNIT 1
MARCH - APRIL 1987

Introduction

Due to the relatively high occurrence of septic failure in the Killearn Lakes subdivision and the storm water control method utilized, known as "sheet flow", the Leon County Health Department conducted a pollution survey of the surface water in the area. This was done to ascertain what effect these septic failures may have on surface water quality in the area and determine whether a public health hazard exists associated with storm water runoff.

Methods

Six sites were chosen in Killearn Lakes Unit One. All six sites were located in an area of known septic failure and in many cases in close proximity to failing septic systems. All six sites were sampled for three consecutive days in three consecutive weeks beginning March 23, 1987, and ending April 8, 1987. The samples were screened for both fecal cloiform and fecal streptococcus using the membrane filter technique at the HRS laboratory in Tallahassee. The north end of Killearn Estates subdivision was chosen as a control site because of its similarities to the test area in lot size, density, soil type and texture, and because septic systems had never been used as a means of sewage disposal in the area. Like Killearn Lakes six sites were selected and sampled on the same dates and tested for the same parameters. Some bias may exist in the selection of sampling sites since only those areas likely to contain water (for the sample dates) were chosen, although the same bias existed in the selection of control sites.

Fecal coliform and fecal streptococcus were chosen as test parameters because in combination they may provide more specific information concerning the source of pollution. According to the "Standard Methods for the Examination of Water and Wastewater" fecal coliform/fecal streptococcus ratios of 4.1 or higher indicate pollution from human excreta while ratios lower than 0.7 indicate pollution due to nonhuman source. Ratios between 0.7 and 4.4 suggests pollution of mixed human and animal source. These ratios are not valid inicators of pollution source when fecal streptococcus levels are below 100 colonies/100ml water.

Interpretation of Data

Table I and II show the actual per day per site fecal coliform (FC) and fecal streptococcus (FS) levels for both Killearn Lakes and Killearn Estates subdivisions for each week of the test period. A three day site specific average was also established for each week of the test period. From this a site specific average for the test period was obtained and plotted on a graph (table III). All of the FS samples in both subdivisions were substantially below the 100/100 ml needed to confirm human or animal contamination.

By comparing rainfall data (table IV) with the FC and FS levels we can see that in most cases there was a slight to moderate increase in both

FC and FS during light rain events. Less pronounced fluctuations existed on days of heavy rain in most cases. Periods of no rain displayed similar FC and FS levels as well as daily fluctuations to those of heavy rain. When the control area and the test area are compared using the rainfall data we find that both areas react in much the same way with no significant differences, or predictable patterns in the rise and fall of FC and FS levels due to rainfall amounts.

Conclusions

The data obtained indicates that relatively low levels of fecal coliform and fecal streptococcus are present and naturally occuring. This is confirmed by the sample results from the control area, Killearn Estates. Although local fluctuations of fecal coliform and fecal streptococcus in Killearn lakes may indicate the possibility of spot sewage contamination, none of the sites sampled exibited a level sufficiently high enough to suggest widespread surface water contamination from failing septic systems.

Prepared By:

L. A. Mahon

L. A. Mahon, Asst. Director
Division of Environmental Health

Table 1 Killearn Lakes Week 1

Date Collected	Site	Location	Fecal Coliform	Fecal Streptococci
3/23/87	1	Rosemont Ridge & Beaver Ford	4	4
3/24/87	1	"	3	4
3/25/87	1	"	10	11
		tot	17	19
		ave	5.6	6.3
3/23/87	2	Briarcreek & Beaver Ford	2	11
3/24/87	2	"	1	3
3/25/87	2	"	13	10
		tot	16	24
		ave	5.3	8
3/23/87	3	Ditch on Hawks Hill next to Babcock	17	11
3/24/87	3	Ditch between 16R & 17R across Fox Lane	1	2
3/25/87	3	"	12	14
		tot	30	27
		ave	10	9
3/23/87	4	Briarcreek & Hawks Hill	0	0
3/24/87	4	Grey house Larksport & Briarcreek	5	6
3/25/87	4	"	8	5
		tot	13	11
		ave	4.3	3.6
3/23/87	5	Ditch on Briarcreek next to 8017	0	4
3/24/87	5	Ditch Hawks Hill Tr & Briarcreek	0	0
3/25/87	5	Ditch Hawks Hill Tr next to 3409	19	18
		tot	19	22
		ave	6.3	7.3
3/23/87	6	no samples taken	-	-
3/24/87	6	Briarcreek & Wildwood	2	4
3/25/87	6	"	0	0
		tot	2	4
		ave	1	2
		Grand tot	97	107
		ave	5.705	6.294

Killearn Lakes Week 2

Date Collected	Site	Location		Fecal Coliform	Fecal Streptococcus
3/30/87	1	Beaverford & Rosemont Ridge		3	2
3/31/87	1	"		6	3
4/1/87	1	"		1	0
			tot	10	5
			ave	3.33	1.66
3/30/87	2	Briarcreek & Beaverford		5	4
3/31/87	2	"		11	5
4/1/87	2	"		6	3
			tot	22	12
			ave	7.33	4.0
3/30/87	3	Drainage easement across from		11	4
3/31/87	3	Little Fox Lane		3	2
4/1/87	3	"		8	4
			tot	22	10
			ave	7.33	3.33
3/30/87	4	Drainage behind grey house on Larkspur		29	21
3/31/87	4	"		3	4
3/31/87	4	"		3	2
			tot	35	27
			ave	11.66	9.0
3/30/87	5	Hawks Hill Tr.		9	6
3/31/87	5	"		12	5
4/1/87	5	"		9	6
			tot	30	17
			ave	10.0	5.66
3/30/87	6	Briarcreek & wildwood		6	5
3/31/87	6	"		6	4
4/1/87	6	"		9	6
			tot	21	15
			ave	7.0	5.0
			Grand tot	140	86
			ave	7.78	4.78

Killearn Lakes Week 3

Date Collected	Site	Location		Fecal Coliform	Fecal Streptococcus
4/6/87	1	Beaverford & Rosemont		3	1
4/7/87	1	"		1	0
4/8/87	1	"		7	5
			tot	11	6
			ave	3.66	2.0
4/6/87	2	Briarcreek on Beaverford		0	0
4/7/87	2	"		4	1
4/8/87	2	"		5	4
			tot	9	5
			ave	3.0	1.66
4/6/87	3	Ditch across from Little Fox Lane		11	6
4/7/87	3	"		14	7
4/8/87	3	"		4	2
			tot	29	15
			ave	9.66	5.0
4/6/87	4	Ditch behind grey house Larkspur		13	3
4/7/87	4	"		3	1
4/8/87	4	"		3	1
			tot	19	5
			ave	6.33	1.66
4/6/87	5	Hawks Hill Tr. & Briarcreek		3	1
4/7/87	5	"		4	1
4/8/87	5	"		5	4
			tot	12	6
			ave	4.0	2.0
4/6/87	6	Briarcreek & Wildwood		4	2
4/7/87	6	"		6	3
4/8/87	6	"		13	3
			tot	23	8
			ave	7.66	2.66
			Grand tot	103	45
			ave	5.72	2.5

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Table II Killearn Estates Week 1

Date Collected	Site	Location		Fecal Coliform	Fecal Streptococcus
3/23/87	1	Village of Killearn		19	13
3/24/87	1	Behind Church Kelly Forrest & Velda		1	1
3/25/87	1	"	Dr.	23	20
			tot	43	34
			ave	14.3	11.3
3/23/87	2	Pimlico & Bold Venture		7	3
3/24/87	2	Bayshore Dr Canal behind 1st house		11	11
3/25/87	2	"		27	20
			tot	45	34
			ave	15.0	11.3
3/23/87	3	Canal between Lakes Shannon Lakes E		13	9
3/24/87	3	Canal-Shannon Lakes S & McLaughlin		5	11
3/25/87	3	"		13	11
			tot	31	31
			ave	10.3	10.3
3/23/87	4	Ditch into Lake Shamrock		1	6
3/24/87	4	Longford 1st Drainage ditch on L		0	0
3/25/87	4	"		4	5
			tot	5	11
			ave	1.66	3.66
3/23/87	5	no sample taken		-	-
3/24/87	5	Longford across from 3709		2	10
3/25/87	5	Longford by animal cemetary		0	1
			tot	2	11
			ave	1	5.5
3/23/87	6	no samples taken		-	-
3/24/87	6	Edenderry Dr by Golf Course		2	13
3/25/87	6	"		0	1
			tot	2	14
			ave	1	7
			Grand tot	128	135
			ave	8.0	8.437

Killearn Estates Week 2

Date Collected	Site	Location		Fecal Coliform	Fecal Streptococcus
3/30/87	1	Behind Church Kelly Forrest & Velda		7	4
3/31/87	1	" Dairy		4	2
4/1/87	1	"		6	3
			tot	17	9
			ave	5.66	3.0
3/30/87	2	Bayshore		0	0
3/31/87	2	"		3	1
4/1/87	2	"		11	4
			tot	14	5
			ave	4.66	1.66
3/30/87	3	Shannon Lake & McLaughlin		11	5
3/31/87	3	"		3	3
4/1/87	3	"		28	20
			tot	42	28
			ave	14.0	9.33
3/30/87	4	Longford Drive		1	0
3/31/87	4	"		0	0
4/1/87	4	"		0	0
			tot	1	0
			ave	0.33	0
3/30/87	5	Longford Drive by animal graveyard		4	3
3/31/87	5	"		14	6
4/1/87	5	"		3	2
			tot	21	11
			ave	7.0	3.66
3/30/87	6	Edenderry Drive by golf course		0	0
3/31/87	6	"		19	6
4/1/87	6	"		9	5
			tot	28	11
			ave	9.33	3.66
			Grand tot	123	64
			Ave	6.83	3.55

Killearn Estates Week 3

Date Collected	Site	Location		Fecal Coliform	Fecal Streptococcus
4/6/87	1	Behind Church Kelly Forrest & Velda		3	1
4/7/87	1	" Dairy		9	7
4/8/87	1	"		5	3
			tot	17	11
			ave	5.66	3.66
4-6-87	2	Bayshore		6	3
4/7/87	2	"		1	0
4/8/87	2	"		2	1
			tot	9	4
			ave	3.0	1.33
4/6/87	3	Shannon Lake & McLaughlin		8	6
4/7/87	3	"		6	3
4/8/87	3	"		3	1
			tot	17	10
			ave	5.66	3.33
4/6/87	4	Longford		9	3
4/7/87	4	"		3	3
4/8/87	4	"		*QNS	*QNS
			tot	12	6
			ave	6.0	3
4/6/87	5	Longford by animal graveyard		6	3
4/7/87	5	"		11	7
4/8/87	5	"		*QNS	*QNS
			tot	17	10
			ave	8.5	5.0
4/6/87	6	Edenderry by golf course		7	5
4/7/87	6	"		0	0
4/8/87	6			3	1
			tot	10	6
			ave	3.33	2.0
			Grand tot	82	47
			ave	5.35	3.05

* QUANITY NOT SUFFICIENT

TABLE III

Site specific 9 day period averages
(colonies/100 ml)

Killearn Lakes

site	fecal coliform	fecal streptococcus
1	4.19	3.32
2	5.21	4.55
3	8.99	5.77
4	7.43	4.75
5	6.76	4.90
6	5.22	3.22

Killearn Estates

site	fecal coliform	fecal streptococcus
1	8.54	5.98
2	7.55	4.76
3	9.98	7.65
4	2.66	2.22
5	5.50	4.72
6	4.55	4.22

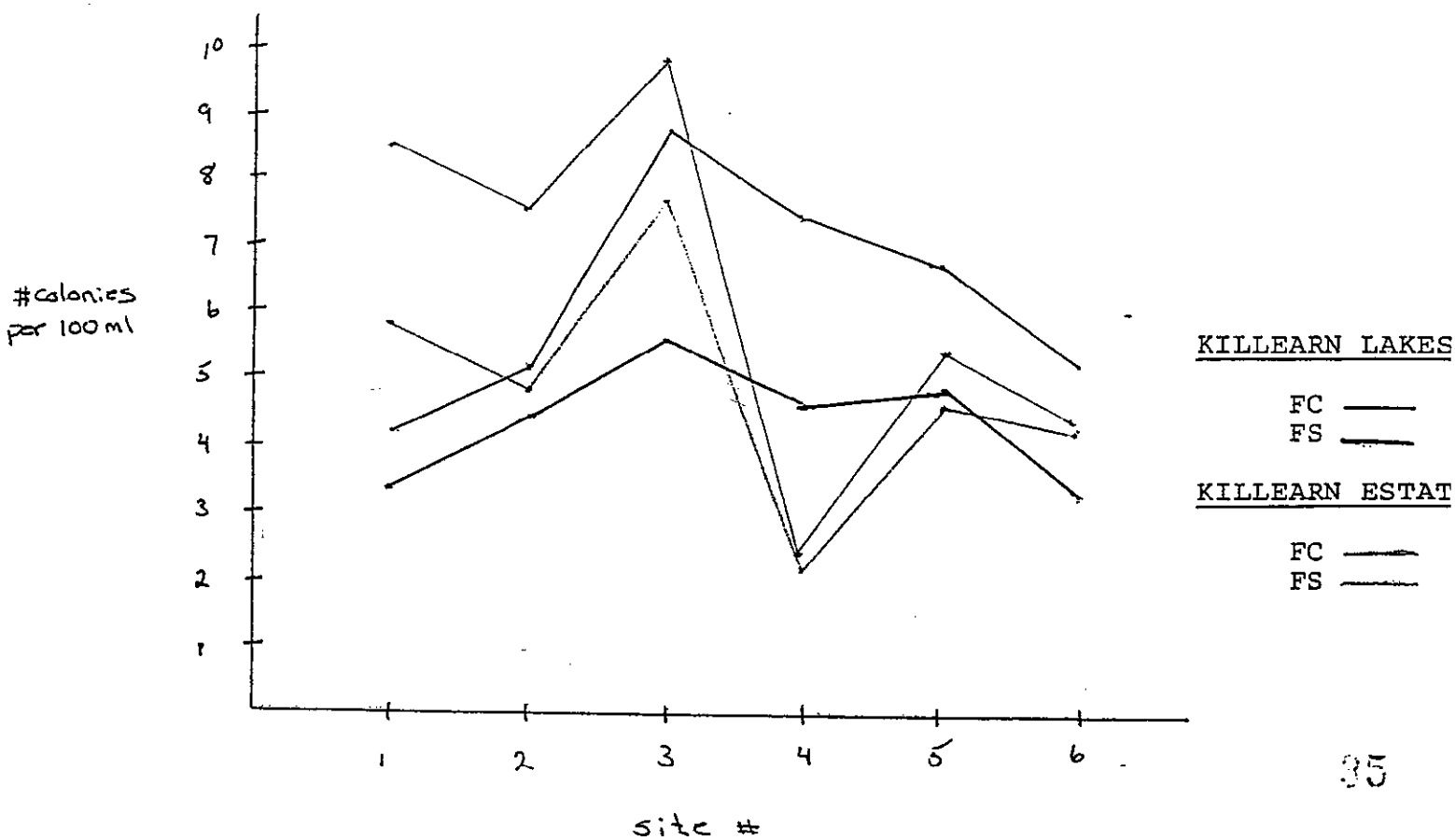

TABLE IV

ıily Rainfall *

ıte	Inches
/23	0.0
/24	0.12
/25	trace
/26	0.84
/27	0.95
/28	0.0
/29	2.11
/30	1.66
/31	0.0
/1	0.0
/2	0.0
/3	0.38
/4-4/9	0.0

Killearn Lakes

Site	Date	FC_1	FS_1	Date	FC_2	FS_2	Date	FC_3	FS_3
1	3/23	4	4	3/30	3	2	4/6	3	1
	3/24	3	4	3/31	6	3	4/7	1	0
	3/25	10	11	4/1	1	0	4/8	7	5
2	3/23	2	11	3/30	5	4	4/6	0	0
	3/24	1	3	3/31	11	5	4/7	4	1
	3/25	13	10	4/1	6	3	4/8	5	4
3	3/23	17	11	3/30	11	4	4/6	11	6
	3/24	1	2	3/31	3	2	4/7	14	7
	3/25	12	14	4/1	8	4	4/8	4	2
4	3/23	0	0	3/30	29	21	4/6	13	3
	3/24	5	6	3/31	3	4	4/7	3	1
	3/25	8	5	4/1	3	2	4/8	3	1
5	3/23	0	4	3/30	9	6	4/6	3	1
	3/24	0	0	3/31	12	5	4/7	4	1
	3/25	19	18	4/1	9	6	4/8	5	4
6	3/23	—	—	3/30	6	5	4/6	4	2
	3/24	2	4	3/31	6	4	4/7	6	3
	3/25	0	0	4/1	9	6	4/8	13	3

Killearn Estates

Site	Date	FC_1	FS_1	Date	FC_2	FS_2	Date	FC_3	FS_3
1	3/23	19	13	3/30	7	4	4/6	3	1
	3/24	1	1	3/31	4	2	4/7	9	7
	3/25	23	20	4/1	6	3	4/8	5	3
2	3/23	7	3	3/30	0	0	4/6	6	3
	3/24	11	11	3/31	3	1	4/7	1	0
	3/25	27	20	4/1	11	4	4/8	2	1
3	3/23	13	9	3/30	11	5	4/6	8	6
	3/24	6	11	3/31	3	3	4/7	6	3
	3/25	13	11	4/1	28	20	4/8	3	1
4	3/23	1	6	3/30	1	0	4/6	9	3
	3/24	0	0	3/31	0	0	4/7	3	3
	3/25	4	5	4/1	0	0	4/8	QNS	QNS
5	3/23	—	—	3/30	4	3	4/6	6	3
	3/24	2	10	3/31	14	6	4/7	11	7
	3/25	0	1	4/1	3	2	4/8	QNS	QNS
6	3/23	—	—	3/30	0	0	4/6	7	5
	3/24	2	13	3/31	19	6	4/7	0	0
	3/25	0	1	4/1	9	5	4/8	3	1

Fecal coliform (FC), fecal streptococcus (FS)

* Rainfall data obtained from National Weather Service

ADDENDUM

PLANNING AND ZONING RECOMMENDATIONS

LEON COUNTY SUBDIVISIONS

The following recommendations are made for improvements in the planning and zoning aspects of land development to better insure that satisfactory conditions exist for the use of onsite sewage disposal systems prior to development.

These recommendations were developed through meetings with the Killearn Lakes Waste Water Disposal Study Group, planning/zoning staff and the Leon County Public Health Unit.

1. All applications for zoning changes should include information regarding the proposed method of sewage disposal and source of potable water. If this information is not provided voluntarily by the applicant, the requested zoning change should be presumed to contain the highest possible density allowed under the requested zoning designation. Recommendations for approval or disapproval will be based on the use of onsite sewage disposal systems (septic tanks) and individual private wells at that density.

2. A representative of the Ochlocknee River Soil and Water Conservation District or the USDA Soil Conservation Service should be included in the review process for zoning and preliminary plat reviews by participating in Technical Coordinating Committee (TCC) activities.

3. All preliminary plat reviews should include sufficient detailed information to asses overall sewage disposal, potable water and storm water needs based on individual lot or block evaluations.

4. Agricultural density should be reviewed to make clear demarkation of intended agricultural use and/or urban use. In agricultural zoning, onsite sewage disposal and private wells should be anticipated. The maximum allowable density under current Chapter 10D-6 standards is two (2) net lots per acre while local zoning designations allow 2.18 lots per acre.